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NATIONAL DAM SAFETY PROGRAM. PORT PERRY DAM (MO 30030), UPPER M--ETC(U)

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DEPARTMENT OF THE ARMY  
ST. LOUIS DISTRICT, CORPS OF ENGINEERS  
210 NORTH 12TH STREET  
ST. LOUIS, MISSOURI 63101

IN REPLY REFER TO

SUBJECT: Port Perry Lake Dam Phase I Inspection Report

This report presents the results of field inspection and evaluation of the Port Perry Lake Dam.

It was prepared under the National Program of Inspection of Non-Federal Dams

SUBMITTED BY:

SIGNED

Chief, Engineering Division

23 FEB 1970

Date

APPROVED BY:

SIGNED

Colonel, CE, District Engineer

23 FEB 1979

Date

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PORT PERRY DAM  
PERRY COUNTY, MISSOURI

MISSOURI INVENTORY NO. 30030

PHASE I INSPECTION REPORT  
NATIONAL DAM SAFETY PROGRAM

PREPARED BY  
Kenneth Balk & Associates, Inc.  
St. Louis, Missouri  
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St. Louis, Missouri

PREPARED FOR  
ST. LOUIS DISTRICT, CORPS OF ENGINEERS  
NOVEMBER, 1978

## PHASE I REPORT

### NATIONAL DAM SAFETY PROGRAM

Name of Dam	Port Perry
State Located	Missouri
County Located	Perry County
Stream	Tributary To Nations Creek
Date of Inspection	September 7 & 8, 1978

Port Perry Dam, No. 30030 was inspected using the "Recommended Guidelines for Safety Inspection of Dams". These guidelines were developed by the Chief of Engineers, U. S. Army, Washington, D.C., with the help of Federal and State agencies, professional engineering organizations, and private engineers. The resulting guidelines are considered to represent a consensus of the engineering profession.

Port Perry Dam was visually inspected by an interdisciplinary team of engineers from Kenneth Balk & Associates, Inc. and Shannon & Wilson, Inc. The purpose of the inspection was to make a preliminary assessment of the general condition of the dam with respect to safety in order to determine if, in the opinion of the interdisciplinary team, the dam poses recognizable hazards to human life or property. This assessment is based solely upon data made available and visual evidence observed during the site visit.

To make a complete assessment of the safety of the dam would require detailed studies and engineering analyses beyond the scope of this preliminary assessment.

Based on the criteria in the guidelines, <sup>This</sup> the dam is in the high hazard potential classification, which means that loss of life and appreciable property loss could occur in the event of failure of the dam. The estimated damage zone extends ten miles downstream of the dam. Within the damage zone are four farmhouses with associated outbuildings, four improved road crossings, and one State highway crossing. There is some farming in the damage zone. Port Perry Dam is in the intermediate size classification since it is greater than 40 feet high but less than 100 feet.


The inspection and evaluation indicate that the spillway of Port Perry does not meet the criteria set forth in the guidelines for a dam having the above size and hazard potential. Port Perry is an intermediate size dam with a high hazard potential, required by the guidelines to pass the PMF. Considering the high hazard potential to loss of life and property downstream of the dam, the outlet facilities of Port Perry Dam should be able to pass the PMF without overtopping the dam. However, it was determined that the spillway will only pass approximately 50 percent of the PMF without overtopping the dam.

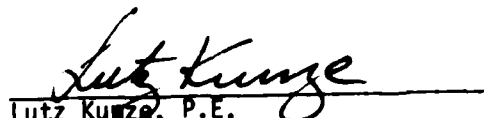
The evaluation of Port Perry also indicated that the spillway will pass the 100-year flood, that is, a flood having a 1 percent chance of being equalled or exceeded during any given year.

Faults were observed in the right abutment. Their location could be considered to be a deficiency. The effect of the faults on the stability of the dam should be assessed by an engineer experienced in the design and construction of dams.

Other deficiencies visually observed by the inspection team were seepage at the juncture of the right abutment and the embankment, erosion, some brush and vegetation in the spillway outlet channel, and water flowing from the pipe of the regulating structure. Other deficiencies found were the lack of seepage records, operational records, seepage and stability analyses comparable to the requirements of the Recommended Guidelines, and seismic stability analyses.

It is recommended that action be taken in the near future to correct or control the deficiencies described.

  
Ervin H. Baumeyer, P.E.  
Principal-In-Charge  
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Overview of Lake and Dam

PHASE I INSPECTION REPORT  
NATIONAL DAM SAFETY PROGRAM  
PORT PERRY DAM - ID NO. 30030

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### A Hydrologic and Hydraulic Analysis Methodology

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2	Location Map
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#### LIST OF PHOTOGRAPHS

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## SECTION 1 - PROJECT INFORMATION

### 1.1 GENERAL

a. Authority. The National Dam Inspection Act, Public Law 92-367, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a program of safety inspection of dams throughout the United States. Pursuant to the above, the St. Louis District, Corps of Engineers, District Engineer directed that a safety inspection of the Port Perry Dam be made.

b. Purpose of Inspection. The purpose of the inspection was to make an assessment of the general condition of the dam with respect to safety, based upon data made available and visual inspection, in order to determine if the dam poses hazards to human life or property.

c. Evaluation Criteria. Criteria used to evaluate the dam were furnished by the Department of the Army, Office of the Chief of Engineers, in "Recommended Guidelines for Safety Inspection of Dams". These guidelines were developed with the help of several Federal agencies and many State agencies, professional engineering organizations, and private engineers.

### 1.2 DESCRIPTION OF PROJECT

a. Description of Dam and Appurtenances.

(1) The dam is an earth structure built on Nations Creek in the southern part of Perry County, Missouri. Topography adjacent to the valley is rolling to steep. Topography in the vicinity of the dam is shown on Plate 1.

(2) A spillway is cut in dolomite and sandstone on the right abutment (south end of the dam).

(3) A 24 inch diameter C.M.P., with a flap gate at the upstream end and a gate valve at the downstream end extends through the embankment near its center.

(4) Pertinent physical data are given in paragraph 1.3 below.

b. Location. The dam is located in the southwestern portion of Perry County, Missouri, as shown on Plate 2. The lake formed by the dam is on the Missouri-Perry County Parker Lake quadrangle sheet in the SE 1/4 of Section 8, T34N, R9E.

c. Size Classification. Criteria for determining the size classification of dams and impoundments are presented in the guidelines referenced in paragraph 1.1c above. Based on these criteria, this dam and impoundment is in the Intermediate size category.

d. Hazard Classification. Guidelines for determining hazard classification are presented in the same guidelines as referenced in paragraph c. Based on referenced guidelines, the Corps of Engineers has determined that this dam is in the High Hazard Classification and thus has been selected by the Corps of Engineers for a Phase I inspection.

e. Ownership. It is reported that the dam is owned by Mr. Vincent Kovarik, R.R. #2, Box 255 A, Imperial, Missouri 63042.

f. Purpose of Dam. The dam forms a recreational lake.

g. Design and Construction History. Some design plans were made available, however, no construction records are known to exist. According to information supplied by the Corps of Engineers, the dam was completed in 1973. A post-construction change evident was the grouting of the pipe of the regulating structure on the downstream slope of the embankment.

h. Normal Operating Procedure. Normal rainfall, runoff, transpiration, evaporation, and spillway discharge all combine to maintain a relatively stable water surface elevation. A regulating structure exists near the center of the embankment. No operating records were found.

### 1.3 PERTINENT DATA

a. Drainage Area - 1993 acres.

b. Discharge at Damsite.

(1) Channel Spillway - 1775.6 cfs. at maximum pool.

(2) Estimated experienced maximum flood - approximately five feet below top of dam, with discharge of approximately 486 cfs.

c. Elevation (U.S.G.S.)

(1) Top of dam - 763 $\pm$ .

(2) Invert of channel spillway - 753.4.

(3) Spillway Crest - 753.4.

(4) Water surface at time of inspection - 749.8.

(5) Streambed at centerline of dam - 693 $\pm$ .

(6) Maximum tailwater - unknown.

d. Reservoir. Length of maximum pool - 5900 feet  $\pm$ .

e. Storage (Acre-feet).

- (1) Normal - 4500
- (2) Maximum - 6506

f. Reservoir Surface (Acres).

- (1) Top of dam - 237.
- (2) Spillway crest - 187.

g. Dam.

- (1) Type - earth embankment.
- (2) Length - 900 feet.
- (3) Height - 70 feet maximum.
- (4) Top width - 30 feet.
- (5) Side Slopes (measured by slope meter/inclinometer in degrees and converted to ratios).

(a) Downstream - 2.25 H. to 1 V.

(b) Upstream - 2.75 H. to 1 V.

- (6) Zoning - unknown
- (7) Impervious core - unknown
- (8) Cutoff - unknown
- (9) Grout curtain - unknown

h. Diversion and Regulating Tunnel. - None

i. Spillway.

- (1) Type - rock channel
- (2) Crest elevation - 753.4

j. Regulating Outlets. - 24" c.m.p. with gate valve at downstream outlet for reservoir drawdown.

## SECTION 2 - ENGINEERING DATA

### 2.1 DESIGN

Some design plans were made available for inspection at the office of the owner. These consisted of three drawing sheets. One entitled "Key & Core Excavation Of Dam For Lake Perry" depicted key and core trench, and some boring logs. The second sheet showed typical dam cross sections. The third sheet entitled "Cross Section Of Overflow System", contained details of the 24 inch C.M.P., valve, and flap gate.

### 2.2 CONSTRUCTION

According to information supplied by the Corps of Engineers, the dam was completed in 1973. Remedial design construction data relative to grouting the pipe of the regulating structure was not readily available.

### 2.3 OPERATION

No records of the maximum loading on the dam were available.

### 2.4 EVALUATION

a. Availability. Some engineering data were made available, as outlined in Section 2.1. A geological report by the Missouri Geological Survey was made available.

b. Adequacy. The engineering data made available were insufficient to make a detailed assessment of the design, construction, and operation of the dam. The lack of seepage and stability analyses comparable to the requirements of the Recommended Guidelines is considered a deficiency which should be corrected. An engineer experienced in the design of dams should be retained to perform detailed seepage and stability analyses.

c. Validity. Some valid engineering data on design were available. See Section 2.1.

## SECTION 3 - VISUAL INSPECTION

### 3.1 FINDINGS

A. General. A visual inspection of the Port Perry Dam was carried out on September 7 & 8, 1978. Personnel making the inspection were employees of Kenneth Balk and Associates, Inc. and Shannon and Wilson, Inc. of St. Louis and included civil, geotechnical, and structural engineers and an engineering geologist. Specific observations are discussed below.

B. Dam. The inspection team observed the following at the dam.

The dam is an earth embankment with a hard-packed earth and gravel road extending the length of the crest. No detrimental settlement, depression, animal burrows, cracking or slope instability was observed on or near the embankment.

The downstream slope has no erosion protection and erosion channels 6 to 12 inches deep and approximately 1 foot wide were observed all along the slope. The large area off the downstream side of the left or north abutment appears to have been the borrow area for the dam and is also without erosion protection. The general slope of the area is towards the dam and the runoff from it has cut a large gulley which is eroding the juncture of the abutment and the dam.

One isolated area of seepage was observed in a rock crevice approximately 1/3 the way up from the toe along the juncture of the right abutment and the dam. The amount of seepage was estimated to be less than a GPM.

Erosion protection on the upstream slope of the dam consists of rip rap, with an average rock size of 6 inches.

C. Appurtenant Structures. A spillway consisting of a 16 foot wide flat bottom channel, with a longitudinal slope of approximately 4%, is cut on the right abutment in moderately hard dolomite and sandstone. A 24" CMP regulating pipe for reservoir drawdown exists near the center of the embankment. There is a gate valve at the downstream outlet. At the time of inspection, water was flowing through the pipe of the regulating structure and we were advised that this was due to a jammed intake in the lake. According to the drawing examined, this pipe is open at the upstream end, with its invert at the lake bed. This opening is protected by a trash rack constructed of No.6 reinforcing steel bars. A 24 inch Armco Heavy Duty Flap Gate, also protected by a trash rack, is set 8 feet above the pipe invert. This gate is apparently intended to be operated by a cable and winch arrangement. At the time of the inspection, no visual evidence of a cable or winch was evident. It would appear that failure of the downstream gate valve could lead to complete loss of the pool.



Grout pipes were observed on the assumed center line of the regulating pipe on the downstream face of the embankment. The regulating pipe empties into a pool of almost black water at the toe of the dam. The water has a very strong odor, the cause of which could not be visually determined. Some brush and vegetation were observed in the spillway outlet channel.

D. Reservoir Area. No wave wash, excessive erosion or slides were observed along the shore of the reservoir.

E. Damsite Geology.

1) Right Abutment - The right abutment is structurally disturbed. Three (3) normal faults were observed and with their approximate displacement are shown on Plate 5. Relative displacements are also shown. Dip and strike of the faults as observed are:

Fault #1,	dip 65°NE,	Strike, almost NS
Fault #2,	dip 61°SE,	Strike, 50°NE
Fault #3,	dip 82°SW,	Strike could not be determined

The following formations are exposed on this abutment:

Thinly bedded, light gray, finely crystalline, moderately weathered, hard and moderately fragmented dolomite. Light yellow to light brown on weathered surface interbedded with thin beds of medium grained, light gray, moderately hard sandstone. White chert nodules are also present throughout this formation. This formation is overlain by massive hard, relatively fresh, light gray, moderately bedded dolomite. These strata probably comprise a part of the Upper Gasconage Formation of the Canadian Series of the Ordovician System. This formation is sparsely jointed with horizontal bedding. Two sets of joints were observed:

Joints: Dip 75°NW, Strike, could not be measured.  
Dip Vertical, Strike, 50°SE

A bed of porous, white to yellowish in color, soft, coarse grained shaley sandstone, which is probably a portion of the lower Roubidoux Formation is underlain by thinly bedded, finely crystalline, moderately weathered, moderately fractured, light gray dolomite. The sandstone also contains white chert nodules.

2) Left Abutment - No outcrop was noted in the left abutment, which is covered with a residual soil.

3) Spillway and Outlet Channel - Spillway and the outlet channel are cut on the right abutment in bedrock. To avoid duplication, description of the strata is described in geology of right abutment.

### 3.2 EVALUATION

The erosion channels observed on the downstream slope and at the juncture of the left abutment, if left uncorrected, may adversely affect the stability of the dam. The intake valve of the regulating pipe should be repaired to make the regulating facilities operational, and consideration should be given to the design and construction of some means to prevent loss of pool in the event of failure of the downstream gate valve. In addition, lack of a positive means of closing off the pipe could lead to serious consequences in the event of pipe or joint failure. The location of the faults in the right abutment, in our opinion, could be a deficiency and the effect of the faults on the dam's stability should be assessed in detail by a professional engineer, experienced in the design of dams. The deficiencies noted above should be corrected. The upstream erosion protection appears adequate for this dam.

## SECTION 4 - OPERATIONAL PROCEDURES

### 4.1 PROCEDURES

A regulating structure exists in the lake near the center of the embankment for maintenance draw down. However, the inspection team was informed that the upstream flap gate is presently jammed and therefore inoperable.

According to the drawing examined, the upstream end of the 24 inch C.M.P. is open, although protected by a trash rack. A 24 inch Armco Heavy Duty Cushion Flap Gate, also protected by a trash rack, is placed 8 feet above the invert of the 24 inch C.M.P. Apparently, the flap gate is intended to be controlled by a cable-winch arrangement.

The lake level is affected by rainfall, runoff, evaporation, and the capacity of uncontrolled spillway and the regulating structure.

### 4.2 MAINTENANCE OF DAM

No maintenance records of the dam were available.

### 4.3 MAINTENANCE OF OPERATING FACILITIES

No maintenance records were available.

### 4.4 DESCRIPTION OF ANY WARNING SYSTEM IN EFFECT

The inspection team is not aware of any existing warning system for this dam.

### 4.5 EVALUATION

In our opinion, the upstream reservoir inlet valve should be repaired and a record of future maintenance kept. In addition, consideration should be given to the design and construction of some means of preventing loss of pool should the 24 inch gate valve at the downstream end of the pipe fail.

## SECTION 5 - HYDRAULIC/HYDROLOGIC

### 5.1 EVALUATION OF FEATURES

a. Design Data. There were no hydraulic and hydrological design data made available, with the exception of that discussed in Section 2.

b. Experience Data. The drainage area and lake surface area are developed from USGS Parker Lake Mo. Quadrangle, 7.5 minute series, dated 1959. The spillway and dam layout are from surveys made during the inspection. The bench mark used was the top of the fish screen in the spillway channel, reported to be Elevation 755.0.

c. Visual Observations. The rock spillway and outlet channel are in good condition. The spillway and outlet channel are located at the right or south abutment. A fish screen is located in the inlet channel. Spillway discharges, in our opinion, would not endanger the integrity of the dam.

Water was flowing through the 24 inch regulating pipe. This has probably contributed to the relatively low water surface elevation.

d. Overtopping Potential. The spillway has been found to be inadequate to pass the Probable Maximum Flood (PMF) without overtopping the dam. The probable maximum flood is defined as the flood discharge that may be expected from the most severe combination of critical meteorological and hydrologic conditions that are reasonably possible in the region.

For the PMF, the dam would be overtopped to a maximum height of approximately 3.7 feet with a duration of overtopping of approximately 6.3 hours and a maximum discharge rate of 11,309 cfs. In our opinion, failure of the dam may be expected to occur as a result of overtopping for this length of time, particularly in view of the lack of erosion protection on the downstream embankment slope.

The spillway has been found to be adequate to pass a flood of approximately fifty percent (50%) of the PMF.

The spillway has been found to be adequate to pass the 100-year flood, which has a 1% chance of being equalled or exceeded at least once during any given year.

The estimated damage zone extends ten miles downstream of the dam. Within the damage zone are four farmhouses with associated outbuildings, four improved road crossings, and one State highway crossing. There is some farming in the damage zone.

## SECTION 6 - STRUCTURAL STABILITY

### 6.1 EVALUATION OF STRUCTURAL STABILITY

a. Visual Observations. Visually observed conditions which can affect the structural stability of this dam have been discussed in Section 3.

b. Design and Construction Data. No design or construction data relating to the structural stability of the dam were found except that discussed in Section 1.2.

c. Operating Records. No records were available at the time of the inspection. The lack of seepage and stability analyses comparable to the requirements of the recommended guidelines is a deficiency which should be corrected.

d. Post-Construction Changes. No post-construction changes other than referenced in Section 1.3 are apparent.

e. Seismic Stability. The location of Port Perry Dam is in Seismic Zone 2. No engineering data was available to evaluate the seismic stability of the dam and the affect of an earthquake of the magnitude expected in this zone on a dam of this type and size should be assessed.

## SECTION 7 - ASSESSMENT/REMEDIAL MEASURES

### 7.1 DAM ASSESSMENT

a. Safety. Corrective measures in our opinion, should be taken for the deficiencies visually observed by the inspection team, i.e. erosion, growth of vegetation in the spillway outlet channel, lack of erosion cover on the downstream slope, and seepage. The spillway capacity is considered to be inadequate, which is a deficiency that should be corrected.

The existing faults in the right abutment are considered to be, in our opinion, a deficiency and the effect of the faults on the dam's stability should be assessed in detail by a professional engineer, experienced in the design of dams.

b. Adequacy of Information. The engineering design and construction data were insufficient to make a detailed assessment of the dam. The conclusions of this report were based on performance and external visual conditions. A geologic report by the Missouri Geologic Survey was available and was considered in the preparation of this report. The lack of seepage and stability analyses comparable to the requirements of the recommended guidelines is a deficiency which should be corrected. The inspection team considers that these data are sufficient to support the conclusions herein.

### 7.2 REMEDIAL MEASURES

a. O&M Procedures. The following O&M procedures are recommended:

(1) Vegetation should be removed from the spillway outlet channel.

(2) Seepage should be monitored to determine the quantity of flow and sedimentation and it is recommended that corrective measures be designed by an experienced professional engineer based on appropriate analyses.

(3) Erosion channels should be filled and a grass cover planted to prevent recurrence.

(4) The upstream flap gate of the regulating structure should be repaired or replaced, and consideration given to the design and construction of a more positive means of protection against loss of pool.

(5) Spillway capacity and/or height of dam should be increased to pass 100 percent (100%) of the Probable Maximum Flood.

(6) Uptodate records of all future maintenance and repairs should be kept.

(7) The dam should be periodically inspected by an engineer experienced in the design and construction of dams.

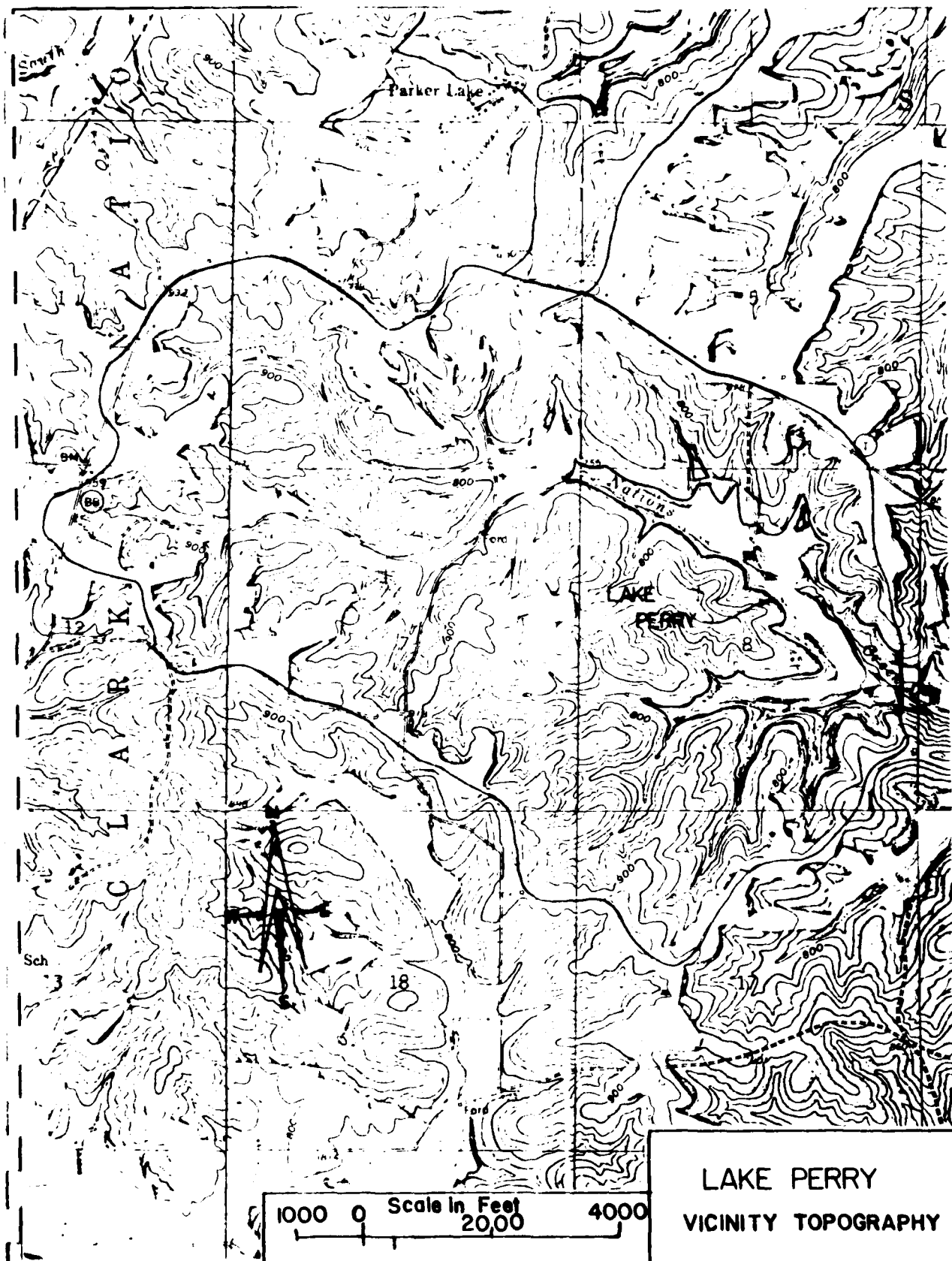
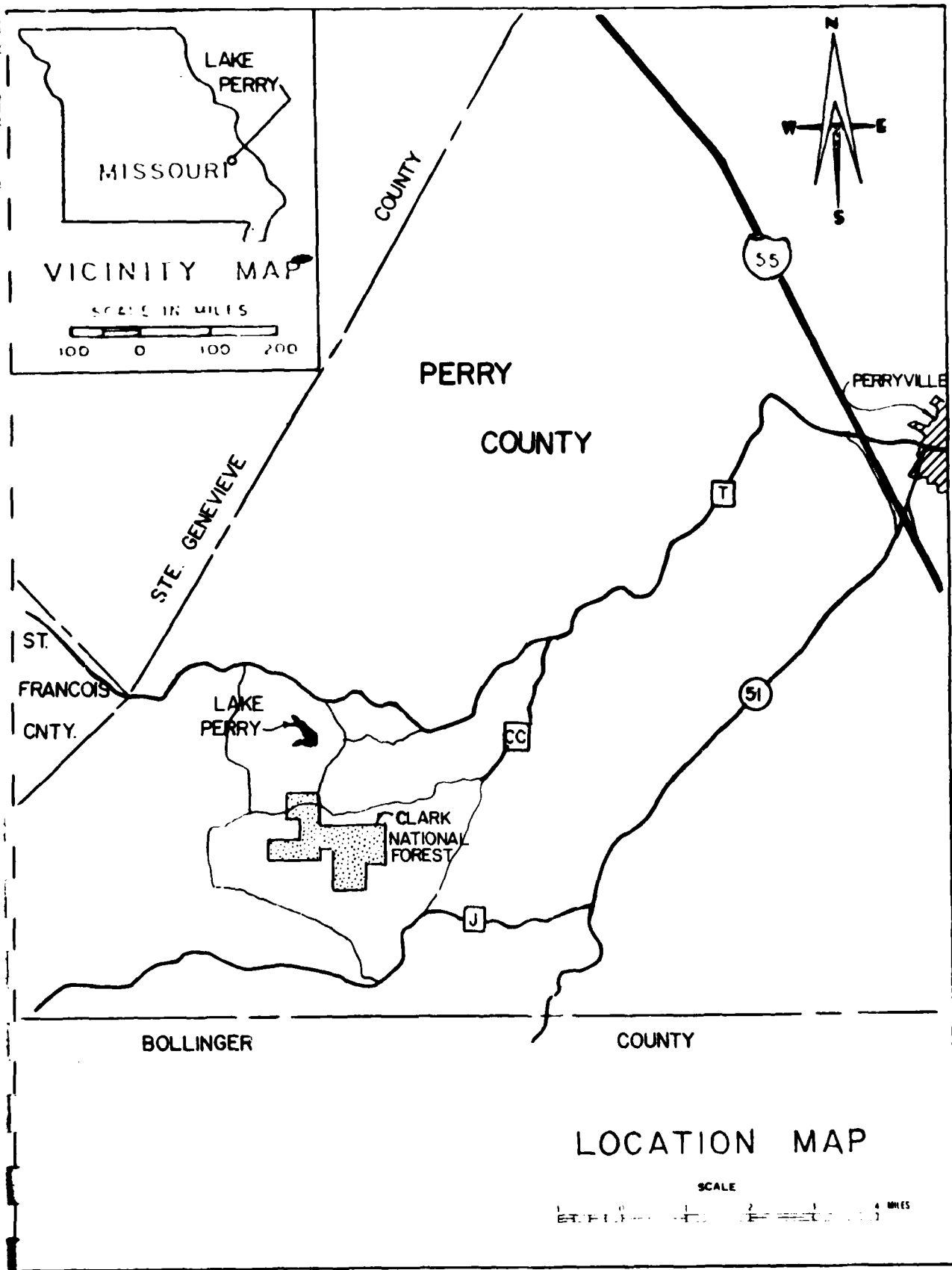
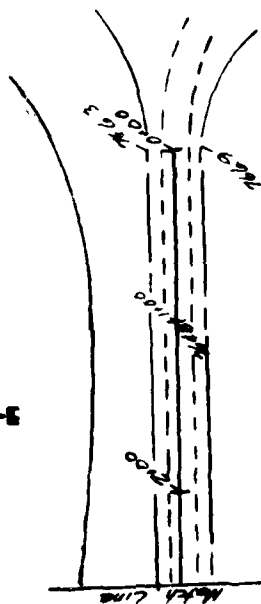
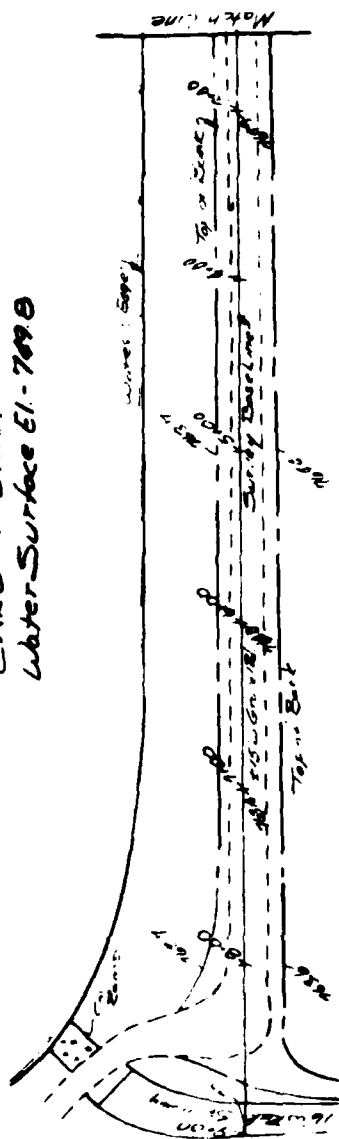


PLATE I





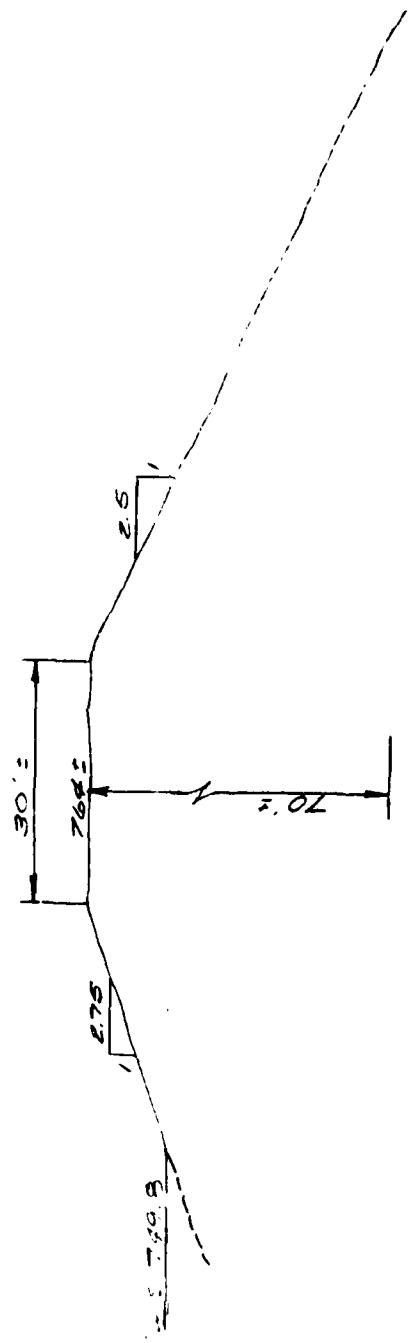
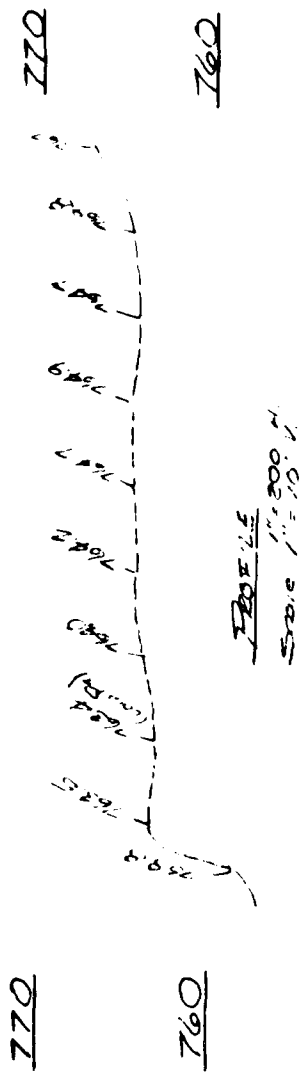
LAKE PERRY  
Water Surface El. - 7090



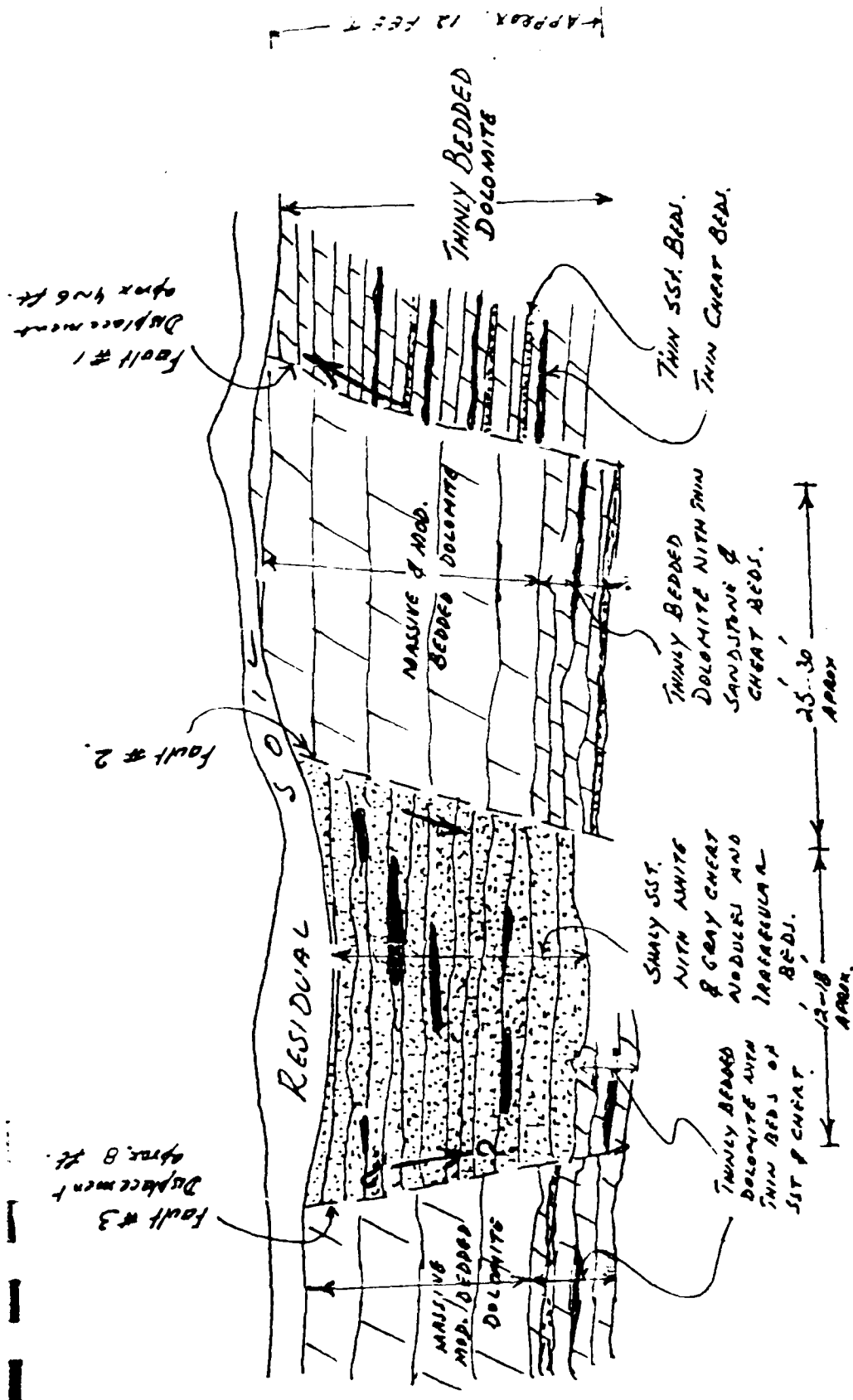
LAKE PERRY

TOP OF DAM  
ELEVATIONS

SCALE: 1"=100' PLATE 3



LAKE PERRY  
DAM PROFILE  
and CROSS SECTION



SKETCH SHOWING  
LOCATION OF FAULTS.  
(NOT TO SCALE)  
VERTICAL SCALE ENLARGED  
PLATE 5

PORT PERRY LAKE DAM.  
RIGHT ABUTMENT



PHOTO 1 Overview of Lake and Dam



PHOTO 2 Crest of Dam



PHOTO 3 Upstream Face of Dam



PHOTO 4 Fish Screen in Spillway Channel



PHOTO 5 Spillway Outlet Channel Looking Downstream



PHOTO 6 Spillway Outlet Channel



PHOTO 7 Right Abutment Showing Fault



PHOTO 8 Grout Pipes

APPENDIX A

HYDROLOGIC AND HYDRAULIC ANALYSIS METHODOLOGY



## HYDROLOGIC AND HYDRAULIC ANALYSIS METHODOLOGY

1. The hydrologic analysis used in development of the overtopping potential is based on applying a hypothetical storm to a unit hydrograph to obtain the inflow hydrograph for a reservoir routing. The Probable Maximum Precipitation is derived and determined from regional charts prepared by the National Weather Service in "Hydro-meteorological Report No. 33." Reduction factors have not been applied. A 24-hour storm duration is assumed with the total rainfall depth distributed over 6-hour periods in accordance with procedures outlined in EM 1110-2-1411 (SPF Determination). The maximum 6-hour rainfall period is then distributed to hourly increments by the same criteria. Within-the-hour distribution is based upon NOAA Technical Memorandum NWS HYDRO-35. The nonpeak 6-hour rainfall periods are distributed uniformly. All distributed values are arranged in a critical sequence by the SPF criteria. The final inflow hydrograph is produced by utilizing the Soil Conservation Service dimensionless unit hydrograph using Hydrologic Soils Group "C", Antecedent Moisture Condition III, and SCS CN 84 used to determine rainfall excess.

Lag time was estimated using methods outlined in "Design of Small Dams", by the United States Department of The Interior, Bureau of Reclamation. Using this source, lag time is taken as 60% of the time of concentration.

Time of concentration was estimated utilizing methods outlined in the source quoted above, supplemented by data obtained during field investigation. The results of the field investigation and the computations indicated that a time of 60 minutes was appropriate. For this lake, a lag time of 0.6 hours was therefore selected.

2. The reservoir routing is accomplished by using Modified Puls routing techniques wherein the flood hydrograph is routed through lake storage. Hydraulic capacities of the outlet works, spillway, and crest of dam are used as outlet controls in the routing. Storage in the pool area is defined by an elevation-storage capacity curve. The hydraulic capacity of the outlet works, spillway, and top of dam are defined by elevation-discharge curves.

3. Dam overtopping analysis has been conducted by hydrologic methods for this dam and lake. This computation determines the percentage of the PMF hydrograph that the reservoir can contain without the dam being overtopped. An output summary in the hydrologic appendix displays this information as well as other characteristics of the simulated dam overtopping.

4. The above methodology has been accomplished for this report using the systemized computer program HEC-1 (Dam Safety Version), July 1978, prepared by the Hydrologic Engineering Center, U.S. Army Corps of Engineers, Davis, California. The numeric parameters estimated for this site are listed in the attached computer printout. Definitions of these variables are contained in the "User's Manual" for the computer program.

5. The inflow hydrograph was routed through the reservoir using HEC-1's Modified Puls option. Releases were calculated for: 1) the channel spillway, and 2) the flow over the top of the dam. These releases were then combined at each of their respective elevations.

Flow through the principal spillway channel was calculated by writing the Bernoulli equation between the lake water surface and the energy gradient elevation in the channel.

With flow in the channel at normal depth, and using the lake water surface as the datum, and, assuming velocity of approach to be zero, the following equation is written:

$$\text{Stage } H = \text{E.G.} + h_e$$

Where Stage H = Lake Water Surface (Pool Elevation)

$$\text{E.G.} = \text{Energy Gradient Elevation in the channel} = \text{depth of flow} + \frac{v^2}{2g}$$

$$h_e = \text{Entrance loss} = k_e \frac{v^2}{2g}$$

$$\text{Where } k_e = 0.5$$

The equation can then be simplified as follows:

$$\text{Stage} = \text{I.E.} + d_f + 1.5 \frac{v^2}{2g}$$

Where I.E. = Invert Elevation

$d_f$  = normal flow depth for a given discharge, obtained using the Manning Equation.

Stage = Pool elevation

Flow over the top of dam was calculated using the weir flow equation:

$$Q = CL(H)^{1.5}$$

where: C = Varies with head as outlined in "Handbook of Hydraulics" by Horace Williams King, revised by Ernest F. Brater.

L = Length in feet (varies with water surface)

H = Head of water in feet (varies with water surface)

Q = Discharge in cfs



FLOW WORK FILE  
 NAM SAFETY VERSION JULY 1978  
 LAST MODIFICATION 3 AUG 78

RUN DATE 11/27/78  
 TIME 17.19.43

PORT PERRY LAKE  
 NOV. 27, 1978  
 MO. INV. NO. 30030

JOE SPECIFICATION  
 NO. 288  
 INAY 5  
 JOPER 5  
 INR 0  
 NWT 0  
 IMIN 0  
 LROPT 0  
 METRC 0  
 TRACF 0  
 IPRT 0  
 MCTAN 0

MULTI-PLAN ANALYSES TO BE PERFORMED  
 MPLAN= 1 MPTIO= 6 LPTIO= 1  
 RTIOS= .20 .30 .35 .40 .50 1.00

SUM-AREA RUNOFF COMPUTATION  
 ISTAQ ICOMP IECON ITAPE JPLT JPT INAME ISTAGE IAUTO  
 INFLOW 0 -0 -0 3 -0 -0 -0

HYDROGRAPH DATA  
 INYNO IUNG TARFA SNAP TRSDA TRSPC RATIO ISNOW ISAMF LOCAL  
 1 2 3.11 -0.00 3.11 1.00 -0.000 -0 1 -0

PRECIP DATA  
 SPFE PMS R6 R12 R24 R48 R72 R96  
 -0.00 26.00 100.00 120.00 130.00 -0.00 -0.00 -0.00

LOSS DATA  
 LROPT STOKR DLTKR RTIOL FRAIN STRKS RTIOK STATL CNSTL ALSMX RTIMP  
 -0 -0.00 1.00 -0.00 -0.00 1.00 -1.00 -84.00 -0.00 .04

CURVE NO = -84.00 WETNESS = -1.00 EFFECT CN = 84.00

UNIT HYDROGRAPH DATA  
 TC= -0.00 LAG= .60

RECESION DATA  
 STRTO= 6.22 ORCSN= -.10 RTIOR= 3.00

UNIT HYDROGRAPH 3R END OF PERIOD ORIGINATES, TC= -0.00 HOURS, LAR= .60 VOL= 1.00  
 119. 360. 697. 1187. 1730. 2124. 2120. 2333. 2222. 2016.  
 1760. 1424. 1105. 884. 716. 549. 479. 348. 313. 252.  
 204. 164. 132. 104. 84. 71. 58. 47. 37. 31.  
 25. 21. 18. 14. 11. 8. 5. 2.

END-OF-PERIOD FLOW  
 MO.DA HR.MN PERIOD RAIN EXCS LOSS COMP 0 MO.DA HR.MN PERIOD RAIN EXCS LOSS COMP 0  
 1.01 .05 1 .01 .00 .01 6. 1.01 12.05 145 .22 .20 .01 1635.  
 1.01 .10 2 .01 .00 .01 5. 1.01 12.10 146 .22 .21 .01 1687.  
 1.01 .15 3 .01 .00 .01 4. 1.01 12.15 147 .22 .21 .01 1740.

INPUT UNIT HYDROGRAPH





1.01	11.25	147	.07	.00	1597.	1.01	23.30	241	.02	.00	520.
1.01	11.30	134	.07	.00	1600.	1.01	23.35	243	.02	.00	520.
1.01	11.35	134	.07	.00	1603.	1.01	23.40	244	.02	.00	520.
1.01	11.40	140	.07	.00	1606.	1.01	23.45	245	.02	.00	520.
1.01	11.45	141	.07	.00	1609.	1.01	23.50	246	.02	.00	520.
1.01	11.50	142	.07	.00	1611.	1.01	23.55	247	.02	.00	520.
1.01	11.55	143	.07	.00	1614.	1.01	23.55	247	.02	.00	520.
1.01	12.00	144	.07	.00	1617.						

SUM 33.80 31.70 2.10 759583.  
( 859.11 805.11 53.11 21509.00)

PEAK	20756.	6-HOUR	2437.	72-HOUR	2617.	TOTAL VOLUME	759123.
CFS	588.	236.	75.	31.54	21502.		
CMS	24.98	31.54	401.23	5229.	6450.		
INCHES	634.42	4141.	5107.				
MM							
AC-FT							
THOUS CU M							

# HYDROGRAPH AT STAINFLOW FOR PLAN 1. RTIO 1

PEAK	4151.	6-HOUR	527.	72-HOUR	527.	TOTAL VOLUME	151865.
CFS	118.	47.	15.	6.31	1046.		
CMS	5.00	6.31	160.25	1290.			
INCHES	126.88	1046.	1290.				
MM	828.						
AC-FT	1021.						
THOUS CU M							

# HYDROGRAPH AT STAINFLOW FOR PLAN 1. RTIO 2

PEAK	6227.	6-HOUR	791.	72-HOUR	791.	TOTAL VOLUME	227797.
CFS	176.	71.	22.	9.46	4450.		
CMS	7.49	9.46	240.37	1569.	1935.		
INCHES	190.32	240.37	1569.	1935.			
MM	1242.	1569.	1935.				
AC-FT	1532.						
THOUS CU M							

# HYDROGRAPH AT STAINFLOW FOR PLAN 1. RTIO 3

PEAK	7265.	6-HOUR	923.	72-HOUR	923.	TOTAL VOLUME	265763.
CFS	204.	83.	26.	11.04	7526.		
CMS	8.74	11.04	280.43	1830.	2258.		
INCHES	222.05	280.43	1830.	2258.			
MM	1449.	1830.	2258.				
AC-FT	1744.						
THOUS CU M							

# HYDROGRAPH AT STAINFLOW FOR PLAN 1. RTIO 4

PEAK	8303.	6-HOUR	1055.	72-HOUR	1055.	TOTAL VOLUME	303729.
CFS	235.	95.	30.	12.62	8601.		
CMS	9.99	12.62	12.62	12.62	12.62		
INCHES	252.77	12.62	12.62	12.62	12.62		
MM							
AC-FT							
THOUS CU M							

AF UNIT HYDROGRAPH



**PLAN 1 .....**

**ELEVATION  
STORAGE  
OUTFLOW**

INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
753.40	753.40	763.00
0.	0.	2006.
0.	0.	1776.

RATIO OF PMF	.20
	.30
	.35
	.40
	.50
	1.00

MAXIMUM	757.84
RESERVOIR	759.71
W.S.ELEV	760.58
	761.42
	762.99
	766.66

[illegible]

MAXIMUM STORAGE AC-FY	
	864.
	1260.
	1451.
	1639.
	2003.
	2911.

MAXIMUM	447.
OUTFLOW	861.
CFS	1055.
	1277.
	1771.
	11309.

DURATION OVER TOP HOURS	0.00
	0.00
	0.00
	0.00
	0.00
	6.25

TIME OF MAX OUTFLOW HOURS	
1A.43	
1A.75	
1A.75	
1A.75	
1A.67	
1A.43	

TIME OF FAILURE HOURS	0.00	0.00	0.00	0.00	0.00	0.00
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# COMPUTER SUMMARY ANALYSIS

END

DATE  
FILMED

11-81

DTIC